

Functional Plant Biology

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Decrease in the capacity for RuBP carboxylation and regeneration with the progression of cold-induced photoinhibition during winter in evergreen broadleaf tree species in a temperate forest

Yoshiyuki Miyazawa, Kihachiro Kikuzawa and Kyoichi Otsuki

393–401

The negative effects of photoinhibition on photosynthetic CO₂ assimilation capacity of broadleaf evergreen tree species during winter are studied, along with possible causes of variation in photosynthetic CO₂ assimilation capacity among leaves in different light environments. The authors show that the progression and degree of photoinhibition in leaves in varying light environments are associated with loss of photosynthetic capacity, while photosynthetic capacity recovers when photoinhibited leaves are transferred to the shade.

Short-term interactions between nitrate and iron nutrition in cucumber

Miroslav Nikolic, Stefano Cesco, Volker Römheld, Zeno Varanini and Roberto Pinton

402–408

Nikolic *et al.* take an interesting approach to the study of the interactions between Fe and nitrate (NO₃⁻) nutrition, focusing on the mechanisms of uptake of these nutrients by roots. They show that Fe deficiency can limit the acquisition of NO₃⁻, while a lack of both NO₃⁻ and NH₄⁺ can affect Fe uptake by limiting Fe^{III}-chelate reducing activity, and provide insight into the complex mechanism underlying the close interdependence between iron and nitrogen acquisition.

Nitrogen resorption and protein degradation during leaf senescence in *Chenopodium album* grown in different light and nitrogen conditions

Yuko Yasumura, Kouki Hikosaka and Tadaki Hirose

409–417

Yasumura *et al.* report the effects of mineral N deprivation and/or light level on the extent of N resorption (especially the mobilisation of leaf proteins) from senescing leaves of *Chenopodium album*. The study of the mobilisation of soluble proteins and insoluble protein (membrane and structural proteins) fractions makes an important contribution to our overall understanding of whole-plant nitrogen recycling, as influenced by environment.

Impact of defoliation frequency on regrowth and carbohydrate metabolism in contrasting varieties of *Lolium perenne*

Bertrand Lasseur, Jérémy Lothier, Annette Morvan-Bertrand, Abraham Escobar-Gutiérrez, Mervyn O. Humphreys and Marie-Pascale Prud'homme

418–430

This study investigates regulation of fructan metabolism during the regrowth of two *Lolium perenne* varieties, which differ in carbohydrate metabolism. The authors show that persistence of this grassland species after frequent defoliation depends on the plant's ability to accumulate high levels of carbohydrates in the tiller base. The expression of genes involved in fructan metabolism (1-SST and 6-G-FFT) after defoliation depends on the source–sink status of individual tissues.

Cover illustration: Grape growers in the Adelaide Hills, South Australia, have been experimenting with partial rootzone drying as a means of reducing vigour and improving water use efficiency (see Dodd, pp. 439–448). Thanks to Brian Loveys (CSIRO) and Nepenthe Wines Balhannah Vineyard for this autumn photograph of Pinot Noir vines.

Multiple effects of the starch synthase II mutation in developing wheat endosperm

Behjat Kosar-Hashemi, Zhongyi Li, Oscar Larroque, Ahmed Regina, Makoto Yamamori, Matthew K. Morell and Sadequr Rahmand

431–438

Kosar-Hashemi *et al.* characterise the *sgp-1* wheat mutant, which lacks starch synthase II, in a new genetic background and show that the mutant phenotype is not affected by genetic background. They also examine starch granule formation from an early stage of seed development and analyse the chain-length distribution of amylopectin, finding that starch granules in the mutant lines are distorted from around 15 days post anthesis and that starch branching patterns show an increase in proportion of short chains at around the same stage of seed development. There was little effect on starch biosynthetic enzymes in the soluble phase.

Soil moisture heterogeneity during deficit irrigation alters root-to-shoot signalling of abscisic acid

Ian C. Dodd

439–448

The effects of two different irrigation techniques on leaf xylem ABA ($[X\text{-ABA}]_{\text{leaf}}$) are evaluated. Deficit irrigation (DI) involves water being applied to the entire rootzone, while partial rootzone drying (PRD) waters only part of the rootzone. DI plants had a higher $[X\text{-ABA}]_{\text{leaf}}$ than PRD plants with moderate soil drying, but PRD plants had a higher $[X\text{-ABA}]_{\text{leaf}}$ than DI plants as the soil dried further. The data have implications for irrigation scheduling of PRD plants in the field to control crop water use.

Selenium-induced oxidative stress in coffee cell suspension cultures

Rui A. Gomes-Junior, Priscila L. Gratão, Salete A. Gaziola, Paulo Mazzafera, Peter J. Lea and Ricardo A. Azevedo

449–456

Selenium is an essential metalloid element required for key antioxidant reactions in humans and animals but can be toxic to plants at high concentrations. As part of an ongoing investigation of the responses of coffee to abiotic stress, Gomes-Junior *et al.* report the antioxidant responses of coffee cell cultures to added selenite. A rapid increase in lipid peroxidation on exposure to selenite provokes a range of antioxidant responses, particularly glutathione reductase and superoxide dismutase.

Relative amounts of soluble and insoluble forms of phosphorus and other elements in intraradical hyphae and arbuscules of arbuscular mycorrhizas

Megan H. Ryan, Margaret E. McCully and Cheng X. Huang

457–464

Ryan *et al.* continue their cryo-analytical SEM studies to differentiate concentrations of soluble and insoluble P forms in mycorrhizal fungal structures. This paper demonstrates the application of a novel technique to provide insight into how phosphorus is delivered to the roots of host plants. A large proportion of total P in arbuscules was insoluble and the authors suggest that this P is involved in the regulation of inorganic P release to host cells.